MO.E.1_O3 - AGFM for magnetic characterization of samples in A.C. magnetic field

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Vibrating Sample Magnetometers (VSM) [1] and Alternating Gradient Force Magnetometers (AGFM) [2] are commonly used techniques to characterize magnetic materials. They have a similar sensitivity, 10-5-10-6 emu for the VSM and 10-6-10-7 emu for the AGFM and both systems allow the application of relatively large magnetic fields. Nevertheless, they cannot be used to characterize samples in AC because in these two systems, the samples are magnetized under continuous magnetic fields. Inductive methods are required when a sample has to be characterized as a function of frequency [3]. The main limitations of these inductive methods are the maximum field that can be applied to magnetize the sample (around 0.015 T) and the temperature increase in the primary coil. We have designed and fabricated a magnetometer that can work both as an AGFM and as a susceptometer without any modification in the experimental set-up because of the electronics we have developed. Another innovation of our prototype is the possibility of being used to characterize samples in a wide range of frequencies, from 0 to 30 kHz. We have demonstrated the capability of measuring different odd harmonics in a wide range of frequencies for small quantities of ferro-, para- and diamagnetic materials. Our system has also proved to be more adequate than a commercial VSM to characterize small quantities of dia- and paramagnets. Spurious effects such as hysteresis are not observed when measuring few micrograms of this type samples in our system.

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